

In addition to the information contained in the tables, the storm log shows interesting details of the damage from the thunderstorm under the "effect on the Columbia system." In 1921 and 1922 the damage consisted entirely in putting out of commission the 4,325 volts, 13.2 kilovolts, and 33-kilovolt lines. The 66-kilovolt lines were constructed in 1923, but were not in operation until the end of 1925. In 1922 and 1923 in addition to the various circuits being out, trouble was also experienced in flashing of insulators, causing bad pot-heads, hot crosses, and burning out rotary converters.

"Surges" became a prominent source of trouble from the thunderstorm late in 1924, and continued to cause much trouble the two following years. Surges are the dropping of the load on a high-tension line, such as 33 kilovolts, to say, 15 kilovolts, a rise above 33 kilovolts, and then a drop again. This kicks out the circuit. During the year 1925 surges during 10 of the 34 destructive thunderstorms caused 184 outages and probably several more.

Storms during these years apparently caused considerable trouble with arc circuit and direct-current

machines. In the storm log no mention is made of machines being out until April 24, 1926, when the following appears: "Six outages on 66-kilovolt circuits and 5 machines out due to surges." During the remainder of 1926, there were 96 machines out in 17 thunderstorms. This was the first full year of service from the Columbia station, located on the Ohio River 20 miles below Cincinnati, with 171 miles of high-voltage lines transmitting current. Other causes of trouble mentioned most frequently during the last year were: Poles on fire, hot crosses, arc circuits out, and lightning arresters hit.

The area of observation of thunderstorms at the Abbe Meteorological Observatory is practically the same as the area covered by the network of the Columbia system at Cincinnati. The frequency and intensity of the storms as observed have been compared with the damage to the electric system. The electric-power company is only one of the industries affected by the thunderstorm, and similar industries suffer corresponding losses throughout the region of thunderstorms.

CAN THUNDERSTORMS BE CLASSIFIED?

ALFRED J. HENRY

The Editor is moved to these remarks by the classification of thunderstorms given by Mr. Devereaux on p. 115.

Scientists are perhaps never so well satisfied with their efforts as when they have succeeded in classifying some particular phenomenon that hitherto had escaped the hands of the classifier. Classification is common to practically all writers on scientific subjects. First, they observe and then they sort into groups or classes those objects which have one or more features in common, and by this method they arrive at "genera" and then "species," and so on. In the biological sciences such procedure is logical and helpful since the difference between any two classes of objects is significant.

When, however, one attempts to class thunderstorms he must sooner or later discover that about the only thing they have in common is their dependence as to origin on atmospheric instability, however that is brought about.

It has been recognized for many years that one of the two so-called types of thunderstorms, "heat" and "cyclonic" shades imperceptibly into the other and that it is not practicable to distinguish between them.

This was recognized by Mohn and Hildebrandsson, who were probably the first writers to class thunderstorms into two main groups as above indicated. These authors expressly say: "However, it is in Sweden impos-

sible to find a well-defined boundary between these two classes of thunderstorms."¹

Hann and Süring in the former's well-known *Lehrbuch*, follow Mohn and Hildebrandsson and add a third group, viz, those which originate along the borders between warm and cold areas. This class was not named.

It is but natural that further study of thunderstorm phenomena should disclose a greater variety of conditions of origin than has hitherto been recognized, especially if, as Humphreys has done, the form of the isobars at or very shortly after the occurrence of the thunderstorm be made the criterion of classification. Humphreys, as stated by Devereaux, describes five classes, viz, heat, cyclonic, tornadic, trough, and border. The two first named and the last named have already appeared in the literature.

Any classification to be useful should be adopted by the majority of organized weather services; pending such adoption it would seem to be preferable not to stress the grouping by classes, remembering that to the man on the street a thunderstorm is a thunderstorm and nothing more; moreover, there do not seem to be any well-recognized differences between thunderstorms that could be used as criteria for classification.

¹ Les Orages dans la Peninsule Scandinave. Upsala, 1888.